

HOW FREE IS SOVIET SCIENCE?

Technology under Totalitarianism

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NOW that the initial reaction to the Sputniks has worn off, it may be worthwhile taking a glance at Soviet scientific and technological achievement in the longer perspective.

Most of the discussion in the West has so far centered on the achievements of Soviet science and education, rather than on the prospects of space exploration. Fear of the military threat implicit in these achievements is balanced by hope that the increased prestige of science in Soviet society will make for greater rationality and perhaps even undermine the totalitarian structure of the dictatorship. Figures concerning the number of scientists and engineers turned out yearly by Soviet schools and universities have suddenly become a subject of general interest and concern, resulting in all sorts of wild comparisons. While previously Soviet technological progress was ignored, the Sputniks have by now generated fear, so that even some of the more ridiculous claims of Soviet propaganda have gained currency.

The public was evidently caught unprepared for the event; and yet there was really no reason for surprise. It had been known for years that, alongside heavy industry, Soviet policy has consistently given priority to technological education, that science gets preferential treatment as long as it does not clash with Communist ideology, and that

Soviet scientists are showered with privileges, high incomes, and considerable prestige. It was also known that Soviet scientists had achieved considerable successes in the realm of military technology (notably jet aircraft), that in the field of thermonuclear reactions they had already caught up with America in 1953, and that their attitude toward basic research differed from that of Mr. Charles Wilson. Even the earth satellite itself was clearly foreshadowed in the Soviet press, which last year gave particular prominence to the centenary of the "grandfather of the Sputnik," K. E. Tsiolkovsky. On the eve of the launching, the review *Oktyabr* (September 1957) wrote, "There is intensive preparation going on for launching artificial earth satellites."

Western attitudes throughout this period were characterized by incredulity as to the potentialities of Soviet science and technology. This was not simply the result of ignorance, nor was it primarily determined by the traditional stereotypes of "Russian backwardness." The operative factor was rather a belief that totalitarianism was "killing" science. In this respect Lysenko did more harm to Western ballistics than to Soviet biology, for he encouraged skepticism in the West as to the position of science in a totalitarian state. The Lysenko affair from the start led to certain misconceptions concerning the "death of science in Soviet Russia." Details were represented as the whole picture. Oversimplified dichotomies concerning freedom and scientific efficiency, vague assertions about the incompatibility of totalitarianism and fundamental research, provided an excuse for complacency. It is not only in the Communist countries that ideological fervor has a distorting effect on public opinion.

THREE Sputniks have shaken Western complacency about Soviet science, but now there is danger of falling into the opposite extreme, according to a well-known student of Soviet affairs who here makes his debut in COMMENTARY. LEOPOLD LABEDZ, a Polish-born sociologist, is now resident in London, where he is at work on a major study in political science. He is one of the editors of *Soviet Survey*, a periodical dealing with Soviet affairs.

Whatever the political system, science is not easily extinguishable in modern industrial society. The "Aryanization" of physics cost Hitler Germany a great deal, but did not prevent her from achieving remarkable technological results. Stalin's great purge in the 30's certainly affected the Soviet scientific elite. (It also decimated the military elite, but that did not prevent later successes by the Soviet army.) But although Soviet scientists were suffering from political persecution, and research was harassed, the consequences did not affect all branches of science uniformly, and the continuity of research and teaching was only broken sporadically.

Two factors seem to have been overlooked in the general indignation about the persecution of Russian scientists and the practice of deciding scientific controversies by decree. One is that the regime was often ready to "rehabilitate" imprisoned scientists, when the need for their services was realized. Some of the most eminent names among Soviet scientists come to mind: Professor Ramzin, the chief defendant in the celebrated "wreckers" trial of the so-called Industrial party in 1930, was later released from prison, became the head of the Institute of Thermodynamics, and eventually (in the early 40's) received a Stalin Prize for his work. A. N. Tupolev, the aircraft designer, though imprisoned in the 30's, was later reinstated and contributed greatly to the development of Soviet air power; he designed the TU 104 and TU 114 jet airliners, and in 1956, as an Academician and Stalin Prize winner, accompanied Khrushchev on his visit to Britain. L. D. Landau, the child prodigy of Soviet physics, was also persecuted during the Great Purge in 1936-38, but later organized a remarkable school of theoretical physics around him. Such examples, which can be multiplied, tended to be disregarded in the justifiable indignation over the fate of Vavilov and other biologists.

The second point is more paradoxical and is connected with the unintended consequences of political actions. It has often

been maintained that the purge greatly harmed the Soviet military performance in the last war. It is arguable, however, that its effects were not entirely one-sided. A good deal of dead wood may well have been incidentally cut out during that operation. It is indeed more than probable that had the veteran Marshal Budenny, for example, been included among the victims of the purge, the early Soviet operations in the Ukraine in 1941 would have been conducted more effectively. In general, the more experienced senior officers, who were replaced in the purge by younger commanders, might have found it more difficult to adjust themselves to the conditions of modern warfare. It is difficult to say whether the loss in experience was counterbalanced by the gain in adaptability, but the balance sheet is certainly incomplete without taking into account the unintended assets as well as the known liabilities. The same applies to science, where one can also detect some paradoxical consequences of the purges, although in this case they were, of course, more detrimental, since science depends to a greater degree on continuity and past experience. Even so, the commonly accepted picture is incomplete. The mechanism of the purge is more generally apprehended than its various social consequences, including those affecting science.

An example may serve as illustration. In Czarist Russia the study of both mathematics and statistics had been on a very high level, and during the 20's Soviet statisticians continued the tradition of their predecessors. The Moscow Institute of Current Research became a flourishing center of statistical investigations. At the beginning of the planning era, in 1929-30, the Institute was abolished and its head, Professor N. D. Kondratyev, and most of his colleagues were purged because they refused to juggle with statistics. Ever since, Soviet statisticians have been in trouble. Theirs was a delicate subject which, on the practical plane, involved dealing with data concerning the rate of investment and other touchy subjects. The demographic effects of forcible industrial-

ization and political purges were another painful topic. In 1937 the population census was suppressed, the directors of the Census Bureau were executed as "enemies of the people," and many statisticians were arrested. In 1949-50 there came another wave of persecution of statisticians, who were told that they did not conform to the "class character of statistics" and were not sufficiently "party-conscious." Here was what seemed like a perfect example of a process on which a Western author at the time made the following comment:

Since science is to some extent an interconnected web of activities and theories, the several parts stimulating or retarding one another, political control of even a few areas of science may diffuse its harmful effects to other areas. . . . Scientific fanatics and quacks—men like Lysenko in genetics—take over when political authority demands what competent scientists cannot conscientiously give it—particular substantive theories or results on order. Where scientific authority is endangered or destroyed, competent men fear to take a position on scientific theory itself, for the demands of political authority are changeful and make almost any position insubstantial. Even further, in such a situation, competent men avoid a scientific career altogether. In all societies, men seek a *relatively* "safe" occupational career. A "flight from science," perhaps only to the more applied branches of scientific technology, as was the case in Nazi Germany, may be one of the unintended consequences of the extension of political control of science in Russia.*

What really happened in Russia did not quite conform to this pattern. No doubt immense harm resulted from the rigidity of the system, doctrinaire dogmatism, the terror, isolation from the outside world, and the rest of the totalitarian set-up. But there was certainly no "flight from science." A scientific career was, and still is, immensely attractive to Soviet youth, and the risks involved were not greater than in other occupations. According to the Soviet Statistical Yearbook, the number of scientific workers increased from 98,000 to 224,000 between 1940 and 1955, and to 240,000 by 1957 (*Vestnik*

*Bernard Barber, *Science and the Social Order* (Free Press), 1952, p. 82.

Akademii Nauk, No. 10, 1957). Nor was the element of relative "safety" negatively correlated with "pure science," and positively with applied science. The situation was less simple. It is true that the terror produced a flight from danger zones, but the risk was unevenly distributed in different fields at different times, and the party line on science was often dictated by a strange mixture of ideological and pragmatic considerations. Its unintended consequences were not always one-sided. Thus, while it suppressed statistics, it did not prevent mathematicians from pursuing that abstract and innocent game, the theory of probability. To be sure, in 1949 the statisticians were condemned for supposing that their discipline could be based on that doctrine, and statistics was defined as a "social science based on Marxist-Leninist theory." But the mathematicians were left alone. The consequences can only be conjectured, but it is probable that when statistical investigations became more risky, potential students turned to mathematics. A sort of artificial natural selection must have been operative: what was lost in statistics was gained in mathematics. The Russians already had a fine tradition in the "probabilist" branch of mathematics, and this tradition was further developed during the Soviet period. A. N. Kolmogorov became a world authority on the subject, and the school of Soviet mathematical probabilists flourished, while the statisticians were prevented from using probability techniques in industry, to the obvious detriment of Soviet technology. But when in 1955 the Soviet leaders finally realized the potentialities of "quality control" techniques, Bulganin made an earnest appeal for their development in Soviet industry. Since during the quarter century when statisticians were being persecuted, mathematics had provided a refuge, the necessary cadres existed and could be trained to do the job without undue delay.

THIS case suggests the possibility that the flight from risks may sometimes have taken a direction other than that from pure to applied science. The case of cybernetics

likewise shows that the interconnection of scientific activities provides means for the partial absorption of political shocks. When cybernetics was first developed in the West, Soviet publications, particularly *Voprosy Filosofii*, ridiculed it as a utopian and anti-humanist attempt on the part of the decadent imperialists to replace men by machines. But when it dawned on the Soviet leaders that mechanical brains could provide immense advantages, and automation became a Soviet watchword, Norbert Wiener ceased to be a bogey-man and cybernetics was "rehabilitated." The neighboring fields of more abstract disciplines provided the men in this case too, and the first Soviet electronic counting machine (called BESM) was quickly built for the Soviet Academy of Sciences. *Voprosy Filosofii* now claimed that the proper development of cybernetics was only possible on the basis of Marxism-Leninism; popular pamphlets were produced to explain the significance of cybernetics and electronics under such slogans as "Let's look into the future"; and *Vestnik Akademii Nauk* claimed that a translating machine built in the Soviet Union was superior to any in the West!

All this is not to say that physicists are now free to pursue their studies without interference. Stern warnings still abound in the Soviet press that "in circumstances of acute ideological warfare, there can be no question of any kind of neutrality or non-participation in politics among Soviet scientists" (*Vestnik Akademii Nauk*, No. 10, 1957). And the organ of Agitprop gives examples of such participation; they consist of attending various seminars where the history of the party, and dialectical and historical materialism, are taught in a form especially adapted for scientists. The topics dealt with include: "The Achievements of Modern Cosmogony and Dialectical Materialism," "The Formation of a Materialist World Outlook while Teaching Physics," "The Inculcation of a Materialist World Outlook in Lectures on Natural Science," and so on (*V Pomoshch Politicheskomu Samoobrazovaniyu*, No. 3, 1958). But the same organ,

which serves the cause of ideological instruction, indicates that the attendance at such *Politgramota* (i.e. political education) circles has been slack, and that "many of the engineers and technical workers have only a poor knowledge of the works of the classics of Marxism-Leninism." Attendance at such "ideological services," which waste the time and energy of technical and scientific cadres, has no doubt fallen off somewhat since Stalin's death. It is interesting to note that *Kommunist* (No. 1, 1958) pointed out that the number of hours devoted to the "social sciences" (i.e. Marxism-Leninism) at the Moscow Institute of Physics and Technology is lower than that devoted to "social sciences" (i.e. the humanities) at the Massachusetts Institute of Technology. According to *Kommunist*, the figures are 496 and 960 hours, i.e. 23.3 per cent and 45.1 per cent of the curriculum, respectively. Even if the figures should be wrong, the emphasis is significant. (A Western comparison by Alexander G. Korol in *Soviet Education for Science and Technology* gives the opposite impression.)

IT IS common knowledge that since Stalin's death, Soviet scientists have been given more leeway in planning research regardless of State plans. The secretary of the Academy of Sciences, Professor A. V. Topchiev, stresses that after 1953 "a new stage in planning research" led to better results (*Vestnik Akademii Nauk*, No. 11, 1956). The allocation of research funds continues to be generous. According to *Pravda* (February 6, 1956) it was 13.6 billion roubles for that year, or 2.4 per cent of the estimated total budget. The Minister of Higher Education, V. Eliutin, has stated in *Pravda* that there are 767 university-level schools in the USSR (this includes institutions providing evening and correspondence courses) and that 260,000 specialists graduated from them in 1956-57, of whom 71,000 were engineers.* Among the higher educational establishments

*For an analysis of the problem of scientific and technological manpower, see: *Professional and Scientific Personnel in the USSR*, by Nicholas de Witt (Harvard University, 1956).

179 are devoted to engineering and technology, while 138 are polytechnical institutes. All-round technical education is widespread, starting with the so-called "polytechnization" of teaching in the schools, and with 4,000 technical schools (*technikums*) giving technical training to graduates from secondary schools (*Vestnik Vysshey Shkoly*, No. 11, 1957). In general, Soviet scientists do not think that basic research is "something you are doing when you do not know what you are doing," to quote Mr. Charles Wilson's celebrated general (motors) definition. On the contrary, they insist that scientific research should not be restricted by the drive for immediate practical results. This is not always the view of the government, but it is interesting to note the words of the president of the Soviet Academy of Science, Professor A. N. Nesmeyanov, on the subject: "Science has all its roots in practice. Its fruits belong to practice. But the linking of science with practice must not be short-sighted. Often the results of abstract science, precisely because they are all-embracing, are more practical than the results of applied science" (*Vestnik Akademii Nauk*, No. 2, 1957).

The quality of Soviet natural science can, of course, only be assessed by specialists in the various disciplines, but it seems to vary from one field to another. It is in line with routine Soviet procedure that there is an exoteric and an esoteric view of it, one designated for mass propaganda, and the other for the initiated. The same Professor Nesmeyanov, who on the occasion of the 40th anniversary of the revolution uniformly praised the achievements of the various branches of Soviet science in *Pravda* and *Komsomolskaya Pravda*, gave a different evaluation in the above-mentioned *Vestnik*, a periodical with a restricted scientific audience. There he indicated that Soviet science is strong in physics, theoretical mechanics, and mathematics; weaker in astronomy and chemistry; and weak or deficient in biology, geology, and certain technical disciplines. This is a more severe assessment than the one given by *Fortune* (No. 2, 1957). As to the "general sciences," by which the Rus-

sians mean philosophy, economics, history, literature, law, and languages, the Professor considers them below standard, and dismisses them in one sentence as "very patchy."

FOR propaganda purposes, Soviet publications are much less candid and eagerly seize upon any Western statement praising their efforts or achievements, while dismissing more critical assessments. Thus *Kommunist* noted with satisfaction the laudatory side of the estimate of Soviet science in the *Fortune* article, while dismissing all its other comments as malicious, false, and demagogic. Similarly, I. Kuzminov in *International Affairs* (No. 3, 1958) quoted with approval Dr. Libby's statement in an interview given to the *U.S. News and World Report* (August 1957) in which he "acknowledged the superiority of the Soviet Union in training scientific and technical personnel." But nothing is said about the problems now besetting Soviet higher education which shows some symptoms of over-expansion. In guarded words *Planovoe Khozyaistvo* (September 1957) intimated that a level has been reached which "permits at the present time the fulfillment of requirements for specialists . . . in all branches of the national economy and culture." As a result the number of specialists trained in the higher educational establishments shows a tendency to decline; this is most probably a deliberate policy, independent of the lower output of university candidates now graduating from secondary schools, who are fewer because they come from age-groups affected by the war deficiency in the birth rate. There also seem to be surpluses of specialists in some fields, while shortages still remain in others.*

Because of the over-expansion of the Soviet educational system (for uneven development is not confined to the capitalist economy), a new phenomenon has appeared in the Soviet economy: unemployment among the young. This will probably result (for other, more weighty, reasons too) in a certain shift in

*W. M. Matthews: "Youth Unemployment in the Soviet Union," unpublished manuscript, Oxford University.

Soviet science, with greater emphasis being given to quality rather than quantity. Competition for admission to Soviet higher educational establishments is becoming fiercer, and entrance requirements are being raised, a phenomenon not confined to the Soviet Union. The result will be a further differentiation between various levels of technological education. A Western critic, Mr. A. G. Korol, has suggested that "when ultimately the Soviet people gain a decisive voice in the allocation of their intellectual and physical resources . . . their schools will produce better but fewer engineers." It would seem that this aim can be achieved without the Soviet people having a say in the matter, simply through the need to re-allocate manpower resources and to adjust the educational system to the march of economic development.

AN IMPORTANT consideration in analyzing Soviet science has to do with the nature of scientific work in general. Like other human activities, science has become a field of specialization, i.e. increased division of labor, on the basis of large-scale organization bureaucratically controlled, and is planned to a far greater degree than was the case previously. The administration of research and planned discovery, with laboratory assistants carrying out work previously done by the "stars"—all these characteristics of contemporary scientific work fit the general bureaucratic character of the Soviet system. The Soviet Academy of Sciences has become a gigantic organization planning, coordinating, and controlling scientific activities.* But contrary to a widespread notion, the problem of financing research does not differ fundamentally in the Soviet Union from the situation in other, less bureaucratic societies. It is only in the fields to which the government assigns first priority that finance ceases to be a problem. The multipli-

cation of staffs in response to real or supposed organizational needs is indeed more accentuated in the USSR than in the Western countries. Another penalty of the bureaucratic organization of science—pseudo-research—is also not a Soviet monopoly, but it is magnified by totalitarian interference with scientific authority.

This last factor is the real crux of the matter in the prevalent Western criticisms of the Soviet attitude to science. Crucial it is, but perhaps not quite in the manner often supposed. Freedom of research may be an important value, but is not the only factor yielding results. The moral or political issue of the value of the individual is not to be confused with the factual problem of the indispensability of the individual scientist for the eventual outcome of research. Some scientists are irreplaceable, others are not. But in the long run all large-scale organizations disregard the former assumption. In terms of individual freedom, the lonely inventor, such as Lopatkin in Dudintsev's protest novel, *Not by Bread Alone*, gets all the sympathy; in terms of technological efficiency, the issue of his dialogue with the bureaucrat, Drozdov, is much less clear-cut. It may well be that there is some point in Drozdov's argument that improvements in pipe production can be more efficiently attained through the routine work of bureaucratically controlled organization than through the eccentric activities of an individual genius. In any case, since this Soviet novel shows that bureaucratic routine also includes stealing ideas, there is little room for argument so far as the efficiency of the system is concerned. That does not detract from the value of the individual or social protest embodied in Lopatkin, but the author may be thought to have confused the issue by presenting his hero's problem as ultimately dependent on the ideologically acceptable question of greater or lesser technological efficiency. The point was not lost on such Soviet critics as Surkov, who triumphantly counterposed the Sputnik to Lopatkin with his home-produced gas pipes.

All this is not to say that totalitarian inter-

*See Alexander Vucinich, *The Soviet Academy of Sciences* (Stanford University Press, 1956). The Academy now has 105 scientific research institutes in which more than 15,000 persons are employed (*Vestnik Akademii Nauk*, No. 10, 1957).

ference with science is a negligible factor and that on balance regimented science is more effective than free science. As Stepan Dedijer has rightly observed, there are two specific factors which have to be taken into account in assessing Soviet scientific successes: "First, it is a very large country; and secondly, it started with a scientific tradition."* In this respect Sir Eric Ashby, who has made sober and timely pronouncements about the potentialities of Soviet science,† may well have underestimated the degree of harm done by what he himself called "the medieval technique of appeal to authority and indictment of heresy." Without the totalitarian strait-jacket, Russian science might well have developed faster. Yet the relationship of Soviet science to Communist ideology is a topic which has confused many analysts. The official case is, of course, that "the Sputniks are not only a demonstration of the tremendous possibilities inherent in the Socialist means of production. They are also a reaffirmation of the correctness of the Marxist-Leninist materialist philosophy."** As against such assertions, a Western critic, after a careful survey of various scientific disciplines in the Soviet Union, comes to the equally orthodox conclusion that "the close link between science and dialectical materialism exercises, if anything, a detrimental effect. . . . The great practical achievements in technology, therefore, have come to pass not *because* of the alliance between Soviet physical science and dialectical materialism but *in spite* of the entanglement of science with ideology."§

ONE can no doubt go on counterposing Soviet technological achievements to Soviet interference with scientific theory, but after a while this exercise becomes fruitless.

**Bulletin of Atomic Scientists*, September 1957.

†Eric Ashby, *Scientist in Russia* (London, 1947); see also B. H. Liddell Hart (Ed.), *The Soviet Army* (London, 1956, pp. 452-450).

**Prof. L. Ilyichov, in the journal *International Affairs* (Moscow, March 1958, p. 11).

§Prof. G. Wetter, in the periodical *Soviet Survey* (London, March 1958, p. 59).

It is evident that such interference has had a detrimental effect on Soviet achievements in many theoretical fields. The wrecking of genetics; the persecution of biologists like Vavilov, Zhrebak, and Orbeli for their "Morganist-Weissmanist" deviations; the Pavlovian stranglehold on psychology, with the resulting ban on psychoanalysis; the purge of Sergeyev and other medical research workers; and the long delay in recognizing the achievements of modern theoretical physics arising from the "idealistic" work of Einstein or Heisenberg—clearly show that Leninist ideology has had a stifling influence on the development of scientific theory in the Soviet Union. Professor Wetter is right in saying that the achievements have come in spite, and not because of, ideological entanglement. Yet, while the power of logic is not the same as the logic of power, neither is perfectly consistent in the real social context. The scientists are not absolutely dependent on the logic of the dialectical *Weltanschauung* in their work, nor are the *apparatchiki* ready to endanger their power by sticking to the logic of ideology, when they realize that to do so is inadvisable on pragmatic grounds. A given scientific theory is then permitted, and by a "creative development" Leninism is reinterpreted so that it becomes possible to claim that the two are not incompatible, but on the contrary that the newly accepted theory could be only developed on the basis of "the most progressive scientific ideology."

The scientists, on their part, are far from being ideal humanists of the Leonardo variety. Only a few are philosophically inclined. Most of them, like their counterparts in the West, know more and more about less and less. Indeed, they know even less about general ideas outside their province than their Western colleagues. If left in peace, very few would busy themselves with questions of the philosophy of science, an occupation pursued everywhere by philosophers rather than by scientists. As matters stand, top-ranking scientists can go about their affairs unconcerned about the compatibility of their notions with Marxism, provided that its

current interpretation does not interfere with their work. Some may accept its general ideas, not bothering about their consistency, while others may believe that dialectical materialism has no application to natural science, but that its scientific character has been demonstrated in the field of social analysis. In general, the "new Soviet intelligentsia" stands in vivid contrast to its predecessor, the pre-revolutionary Russian intelligentsia. It is, on the whole, narrow in outlook, unconcerned with general ideas, and displays all the usual traits connected with technical specialization and bureaucratic dependence. In the Soviet system, the old function of the intellectual has disappeared and his place has been taken by mental technicians. It is not the scientists or the engineers who display residual features of historical continuity, but the *literati* and the students, whose impetus, however, is spent when they are drawn into the administrative routine of daily life, with all its personal worries. Under such conditions, the meaning of ideology for a technical expert may remain ambiguous if its content does not clash too obviously with his interests. Even in its Stalinist or Khrushchevian form it may serve the function attributed by Max Weber to all religions and ideologies: to "make sense" of the world as a total experience.

IN THIS respect "Marxist" ideology, in its Sovietized form, is peculiarly suitable for narrow specialists: it provides them with a *Weltanschauung*, a substitute for religion, in which science is worshipped, and which also satisfies the same need for a mind squeezed by specialization that "primitive magic" did for less sophisticated brains. Its value for a generally critical outlook can be exaggerated. Max Weber has argued that the "magical image of the world" prevented the emergence of science in China, while Protestantism was particularly consonant with scientific activity because of its stress on rationalism and empiricism. Others have narrowed down the beneficial influence of Protestantism on the emergence of science

to one of its variants, Calvinism. Whatever the historical value of these propositions, they have little relevance to the totalitarian experience. "The magical image of the world" may have harmed, but did not preclude, scientific activity in Russia. With the industrialization of China, natural science will play a greater role there, though the Maoist outlook is hardly less "magical" than the Confucian. Yet both empiricism and rationalism (when they do not clash) perform a particular function in "scientific ideology": rationalism is reduced to the role of non-substantive or formal rationality; empiricism—to a peculiar type of pragmatic adjustment within dogmatic doctrinal limits. Ever since Engels, "dialectical pragmatists" have been fond of repeating that "the proof of the pudding is in the eating," but they usually behave as if the taste of the pudding is fixed once and for all. Yet the thesis that science is incompatible with totalitarianism is false as a factual proposition. If Calvinist theology can be considered to have been beneficial to science at a certain time, there is no reason why science cannot coexist (uneasily) with Communist doctrinairism. It has done so in the past, and the post-Stalinist reorientation has made some of the points of conflict less acute.

Another familiar thesis relevant to the problem of the Soviet political structure is that of the growing dependence of politicians on experts. Unmodified, it fits a contemporary totalitarian state even less than Max Weber's doctrines on the subject fitted Imperial Germany. The growing complexity of life and knowledge in modern society makes expert advice indispensable, but this does not lead to *political* dependence on experts. Generalities about industrialization, higher educational levels, and the growing aspirations of managerial strata, have been utilized since Stalin's death to render respectable hopeful forecasts about a democratic evolution of the regime, of which the collective leadership was to be a preliminary step.* Since then, the managers have been

*See Isaac Deutscher, *Russia After Stalin* (1953).

hit by decentralization measures, and there is no more talk about collective leadership. As to the experts, Khrushchev may well hold with a 19th-century German petty despot, the Elector of Hanover, that, like professors and prostitutes, they can be found on every street corner. Their behavior clearly does not cause him much concern. They are competent, often justifiably proud of their achievements, intensely patriotic, and frequently display the same primitive arrogance so characteristic of Khrushchev himself, despite the fact that unlike him, they are not the products of *Rabfaks* (Workers' Colleges). Characteristic in this respect is a speech made by the leading Soviet atomic expert, Academician I. V. Kurchatov, whose lectures once caused such a stir at Britain's atomic power plant in Harwell. Speaking at the March 1958 session of the Supreme Soviet which also witnessed Khrushchev's formal assumption of supreme power, and answering President Eisenhower's message to Bulganin which stressed that the United States had not exploited its temporary monopoly of atomic arms, he asserted that "when the Soviet Union began to accumulate atomic weapons, there were so few in the United States that they could not play any serious role in a war. And hydrogen arms were first built in the USSR and not in the USA" (*Pravda*, April 1, 1958).

IF IT was unrealistic to suppose that state control of science would prevent the Soviet scientists from achieving spectacular results, it is equally unrealistic to expect that contacts with the West will appreciably affect their attitude towards the Soviet system. They have, of course, a stake in its rationalization and in the avoidance of excesses similar to those practiced in the past. But it is Western scientists who now pointed-

ly remark that the difference in pay between a scientist and an unskilled worker is so much higher in the Soviet Union! If Semenov can study chemistry without bothering about the currently orthodox party line on the "theory of resonance," if Bogolubov, Alexandrov, and Fok can occupy themselves with mathematics, without relating it to dialectical materialism, if Kapitza, Blokhinstev, or Landau are able to pursue their researches in nuclear physics unconcerned with the philosophical implications of the indeterminacy principle—in short if the causes of scientific disaffection have been somewhat alleviated—there is no reason to be seen why Soviet scientists should not provide their government with efficient service.

The threat to ideology from the point of view of the regime does not come from the philosophical implications of the natural sciences, but from the humanities and the social sciences. This explains the contrast, often noticed by Western observers, between the levels of the natural and the social sciences in the Soviet Union. As a rule, the closer the subject is to sensitive ideological points, the smaller its chance of unfettered development. In this respect physics appears to be situated fairly far from the magnetic pole, while genetics and psychology are much closer, and sociology is almost on top of it. The hard core of the dogma is sensitive to independent research in these latter fields. While in medieval times Catholic theology was especially touchy about the findings of natural science which seemed to contradict its view of the universe, Communist ideology is particularly vulnerable to critical findings about social structure and development. Since it pretends to be *the* science of society, Soviet Marxism cannot be basically modified without undermining the position of its guardians.